

Appln. No. 10/687,022  
 Amdt. Dated November 29, 2005  
 Reply to Office Action of July 29, 2005

## REMARKS

Applicants acknowledge receipt of the Office Action dated July 29, 2005, in which Claims 66-68, 71-77, 79-92, 95-97, 99, 102-110, 116, 118-124, and 143 are rejected under 35 U.S.C. §102(b) as being unpatentable over U.S. Published Patent Application 2001/0031793 (hereinafter *Singleton*) and furthermore Claims 66-143 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Singleton* in view of U.S. Patent No. 6,465,530 (hereinafter *Roy-Auberger*).

### I. Status of the Claims

Claims 1-65 stand canceled. Claims 66-143 are pending. No claims are currently amended.

### II. Rejection of Claims Under 35 U.S.C. § 102(b).

Applicants respectfully traverse the Examiner's rejection and submit that independent Claim 66 and its dependent claims 67-68, 71-77, 79-92, 95-97, 99, 102-110, 116, 118-124, and 143 are not anticipated by *Singleton*. Applicants submit that *Singleton* does not teach nor suggest all of the limitations of Claim 66 as there is not explicit or implicit teaching of the support structure used in the process of the present Application. Moreover, there is also no teaching nor suggestion in *Singleton* that it would be desirable to solve the problem addressed by Applicants and to achieve Applicants' purpose in the present claimed invention.

*Singleton* teaches a Fischer-Tropsch catalyst comprising a  $\gamma$ -alumina support doped with lanthanum oxide, barium oxide, or a combination thereof, its method of use to make a cobalt catalyst suitable for reacting a synthesis gas in a slurry bubble reactor and a method of preparing this catalyst (see Abstract of *Singleton*). *Singleton* discloses that the addition of the dopant into the alumina structure is preferably effected by the co-hydrolysis of a dopant alkoxide with aluminum alkoxide before boehmite crystallization. Thus *Singleton* teaches that the dopant precursor is contacted with the aluminum alkoxide in dissolved form in an aqueous solution before boehmite crystals are formed (*Singleton* Page 3, paragraphs [0026], [0028] and [0030]). The positive effects that *Singleton* is seeking with such doping of the alumina catalyst support are improved thermal stability of the supported catalyst when it is subjected to repeated reaction-regeneration cycles (*Singleton* Page 2, paragraph [0015]; Page 3, paragraphs [0031] and [0032]), and mitigation of the detrimental effect of small amount of titanium present in alumina (*Singleton* Page 5, paragraph [0064]; Catalyst 4 in Table

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1). Indeed, *Singleton* would like to minimize the impact of high temperature or repetitive cycles of heating for regeneration after reaction on the alumina surface area (e.g., collapse of the alumina structure at high temperature causing a slow decrease of support surface area; and generation of inactive cobalt species) and considers unacceptable the resulting decrease in cobalt surface area in the supported catalyst (*Singleton* Page 2, paragraph [0015]). Moreover, *Singleton* regards titanium to be an impurity, as its addition is incidental during the  $\gamma$ -alumina preparation from aluminum alkoxide (*Singleton* Catalysts 1-3 in Table 1; Page 5, paragraphs [0060] & [0063]), and thus does not regard titanium as a stabilizer as set forth in the present invention.

***Singleton fails to teach Applicants' method of preparation of the support and the resulting support structure***

Although *Singleton* suggests that the dopant could be added at substantially any time (*Singleton* Page 3, paragraph [0028]), Applicants contend that the mere disclosure of the dopant addition "at substantially any time" by *Singleton* without a single specific example is not sufficient to meet the enablement requirement of an anticipatory reference. For example, *Singleton* does not provide any description or guidance of how one could obtain a doped alumina when the alumina is obtained from a process other than one using the hydrolysis of aluminum alkoxide. Indeed, there are many different processes to form boehmite to ultimately make alumina. For example, not only can boehmite be made from aluminum alkoxide, but also from aluminum-containing organic or inorganic salts, or from gibbsite (another alumina hydrate form). More particularly, there is no teaching in *Singleton* on how to add a dopant to boehmite after its crystallization. Applicants submit that the dopant in *Singleton* is added at an earlier stage of preparation of alumina than the structural stabilizer of Applicants, and as such, the alumina precursor compound (e.g., aluminum alkoxide) which contacts the dopant in *Singleton* has a different chemical composition and physical form than the alumina precursor compound (e.g., boehmite, which is a crystalline aluminum hydroxide) which is mixed with the structural stabilizer in Applicants' method. Simply stated, one starting ingredient (i.e., alumina precursor) in the method of support preparation in *Singleton* differs in composition from that of Applicants'.

In addition, Applicants submit that the preparation method for doped alumina disclosed by *Singleton* yields a support structure which differs from that of Applicants, for *different chemical compositions and physical forms of the alumina precursor* used during the preparation of the support

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yield different stabilized support structures. Indeed, the method of preparation of the stabilized alumina and the selection of the starting ingredients (i.e., structural stabilizer compound; alumina precursor) have a large impact on the distribution of the structural stabilizer in the structure of the stabilized alumina and on the connections of the structural stabilizer with Al species in the stabilized alumina structure, and thus result in different stabilized alumina structures. One having ordinary skill in the art would recognize that there is a difference in possible interaction/connection of the structural stabilizer and the alumina precursor whether the alumina precursor is in hydroxide form or in alkoxide form. One having ordinary skill in the art would further recognize that there is a difference in association of the structural stabilizer and the alumina precursor whether the alumina precursor is in dissolved form or in solid form.

For example, a simplified analogy would be illustrated by the difference in donut structures resulting from different preparation methods. One method comprises mixing sugar in a donut dough; forming a portion of the sweetened dough into a ring; and subjecting the ring to heat to generate a sweetened donut; while another method comprises forming a portion of a dough into a ring; subjecting the ring to heat to generate a donut, and applying a powdered sugar glaze onto said donut to form a glazed donut. The former method results in a more homogeneous distribution of the sugar molecules within the sweetened donut, while the later method forms a donut with a 'coating' of sugar particles. Not only the methods result in different structures, but they also create a different effect on consumer taste.

Similarly, in the support preparation method disclosed by *Singleton* which employs co-hydrolysis, the aluminum alkoxide and the dopant alkoxide are in a very intimate association with one another at the molecular scale in their dissolved form before they are subjected to hydrolysis and then heat. Such method would yield a *very even distribution* of the dopant in the resulting doped alumina structure. On the other end, in Applicants' method, the dispersion of the structural stabilizer (or precursor thereof) when mixed with a solid crystalline alumina precursor (i.e., boehmite) is limited by the available porosity of the solid structure of the crystalline alumina precursor, that is to say, the distribution of the structural stabilizer in the resulting support largely depends on its ability to migrate from the external surface of the crystalline alumina precursor solid structure through the pores of the solid structure onto the internal surfaces of the solid structure. In other words, a method employing drying and calcining a mixture of a structural stabilizer and boehmite (in a solid crystalline form) would result on an *uneven distribution* of the structural stabilizer in the support,

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typically characterized as a 'surface coating' of the structural stabilizer. Hence, the method of preparation of doped alumina by *Singleton* does not provide, inherently or expressly, the structure of the catalyst support used in the process of the Applicants' present invention, and as such, *Singleton* does not provide *implicitly* that the structure of the doped alumina is the same as the stabilized support used in Applicants' process.

Applicants submit that any person having ordinary skill in the art with access to *Singleton* could not reproduce the present claimed invention from *Singleton*'s written disclosure.

***Singleton fails to teach the problem and Applicants' intended purpose***

Not only does *Singleton* fail to teach or suggest all of the limitations of Claim 66, there is also no teaching nor suggestion that it would be desirable to 'dope' alumina to solve the problem addressed by Applicants in the present claimed invention and to achieve Applicants' purpose.

For example, with respect to rejected Claims 123-124, *Singleton* does not expressly or implicitly teach the addition of a 'dopant' for *enhancing the hydrothermal stability of the catalyst support*. The hydrothermal stability is defined by Applicants as "stability at elevated temperatures in the presence of water" (see paragraph [0021] of the Applicants' specification as filed). Applicants have disclosed that the hydrothermal stability of support and catalyst can be determined for example by using a steaming test, which comprises exposing a sample to water in an autoclave at a temperature of 225 °C and a pressure of 375 psig (approximating the Fischer-Tropsch operating conditions) for 2 hours (see paragraphs [0127]-[0129] of the Applicants' specification as filed). Thus, hydrothermal conditions not only encompass high temperature but also *presence of steam*.

*Singleton*'s teaching differs from the present claimed invention with respect to the intended effect of the doped alumina as a support for the hydrocarbon synthesis catalyst support. As stated above, *Singleton* discloses two purposes for the doping of alumina derived from aluminum alkoxide: greater thermal stability and mitigation of the detrimental impact of incidental titanium impurity in alumina on the activity of some cobalt alumina-supported catalysts. *Singleton* does not teach nor suggest that the doping of alumina would be effective to provide enhanced stability to the catalyst support under *hydrothermal* conditions. There is no mention in *Singleton* that the formation of water vapor during Fischer-Tropsch synthesis has or could have a negative impact on the stability of the catalyst support. Moreover, *Singleton* does not state that it would be desirable to address this issue of hydrothermal stability of the support, and how one having ordinary skill in the art could do or should

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do to address it. To the extent that *Singleton* teaches the use of a dopant comprising La and/or Ba in alumina for enhancing *thermal* stability of the support and the supported catalyst, *Singleton* does not teach nor suggest the use of this dopant or other dopants in alumina in order to enhance the *hydrothermal* stability of the support, that is to say, in order to prevent *hydrothermal attack* of the support structure by steam (as vaporized water) under the high-pressure high-temperature hydrocarbon synthesis conditions.

Applicants argue that the disclosure of an added element or an added method step which results in modifying a structure in order to achieve a desired effect or desired change on a property of the resulting structure does not *necessarily* teach the desirability of another effect or improvement in another property of the resulting structure, nor does it *necessarily* teach that this modification would have a positive impact on another property of the resulting structure; and nor does it *necessarily* teach that the effect or change on a property of the resulting structure would be beneficial regardless of the composition of the added element. In other words, *a dopant which is known to improve the thermal stability of an alumina support may not necessarily improve its hydrothermal stability.*

Thus, based on *Singleton* as a whole, one having ordinary skill in the art is completely without notice of this important *hydrothermal* effect on the support structure and is not provided enough guidance from *Singleton* how to address it.

In view of all the recitations in Claim 66 that are neither taught nor suggested expressly or implicitly by *Singleton*, and further in view of the lack of guidance from *Singleton* to arrive to the present invention, Applicants argue that *Singleton* does not put the public in possession of the use of the Applicants' catalyst support structure in the present claimed process. Applicants thus submit that *Singleton* does not explicitly or implicitly anticipate Claim 66 for the reasons stated above. Applicants respectfully request that the Examiner withdraw the § 102 rejection on Claim 66 and its dependent Claims 67-68, 71-77, 79-92, 95-97, 99, 102-110, 116, 118-124, and 143.

### **III. Rejection of Claims Under 35 U.S.C. § 103(a).**

In the Office Action mailed on July 29, 2005, Claims 66-143 were rejected in the Office Action under 35 U.S.C. § 103(a) as being unpatentable over *Singleton* in view of *Roy-Auberger*. The Examiner has stated that the present claimed differs from *Singleton*'s teachings in that *Singleton* does not teach the use of a co-precipitated silica-alumina as a structural stabilizer. The Examiner further

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states in Page 4 of Office Action that "it would have been *prima facie obvious* to one of ordinary skill in the art at the time for the invention was made to co-precipitate a mixture of silica-alumina as a structural stabilizer and calcine it at a high temperature in order to improve the mechanical properties, especially when it is used in a slurry bubble column reactor".

Applicants respectfully traverse the Examiner's rejection of Claims 66-143 under § 103 as being unpatentable and submit that, contrary to MPEP section 2143, the Examiner has failed to make a *prima facie* case of obviousness in rejecting such claims in that the combination of the cited references cited by the Examiner fails to teach or suggest all of the elements recited in the rejected claims; both references fail to address the problem Applicants are addressing; and the Examiner has failed to articulate a motivation to combine the references to arrive to the claimed invention.

As a whole, the secondary reference, *Roy-Auberger* teaches a silica-alumina support suitable for supporting a catalyst which is used in hydrocarbon synthesis from synthesis gas. *Roy-Auberger* is mainly concerned with the mechanical stability of a particulate catalyst supported on the silica-alumina support, as the catalyst particles tend to disintegrate into smaller particles during operation (*Roy-Auberger* Col. 6 line 65 to Col. 7 line 1; Col. 5 lines 44-46; Col. 10 line 65 to Col. 11 line 19; Table 3). *Roy-Auberger* discloses several embodiments of a co-precipitation method (*Roy-Auberger* Col. 2 line 48-65; Col. 3 lines 4-25) which result in a silica-alumina support having an *improved mechanical strength* and further characterized by a relatively high degree of Si and Al homogeneities (see disclosure of 'micrometric', 'micronic', and 'nanometric' homogeneities in *Roy-Auberger* Col. 2 lines 40-42; Col. 4 lines 19-28; and the homogeneity measurement method in *Roy-Auberger* Col. 4 lines 59-65). *Roy-Auberger* relates the improved mechanical strength of the silica-alumina support to the presence of more substantial and a greater number of *interactions between the alumina and the silica* in the silica-alumina support which are created by specific calcination conditions after the co-precipitation step (*Roy-Auberger* Col. 2 lines 62-65; Col. 3 line 1-3). *Roy-Auberger* further suggests the desirability to add a small proportion of a 'stabilizing element' to the silica-alumina support, where the 'stabilizing element' is preferably added in the form of a soluble salt (*Roy-Auberger* Col. 3 lines 27-38) and wherein the stabilizing element is in the form of  $M_2O_3$  in the support, where M is La, Pr, or Nd. However, *Roy-Auberger* does not state the purpose for this stabilization. A reasonable inference from *Roy-Auberger*'s teaching is that the stabilizing element  $M_2O_3$  in the silica-alumina support is also used for the mechanical stability of the catalyst,

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since Catalyst D containing La in the silica-alumina support is tested for mechanical stability in a similar fashion as the other Catalysts A-C that do not contain a stabilizing element in their silica-alumina support.

***There is no motivation to combine Singleton with Roy-Auberger to arrive to Applicants' support structure***

Applicants respectfully disagree with the rejection as the combination of *Singleton* with *Roy-Auberger* does not teach nor suggest all of the elements of Claim 66 and, *a fortiori*, also all of the elements of its dependent claims 67-143.

As stated above, *Singleton* fails as a primary reference for not teaching or suggesting all the limitations of Claim 66. The examiner has used *Roy-Auberger* as a secondary reference for his teaching of the silica-alumina support with an improved mechanical strength, its co-precipitation method, and its use in the process of the present claimed invention. The co-precipitation method to prepare the silica-alumina support in *Roy-Auberger* comprises the mixing of dissolved silicon-containing compound and aluminum-containing compound (which is *not in crystalline form*) followed by the co-precipitation of these compounds by acid-base reaction. As stated earlier, *Roy-Auberger* teaches the co-precipitation of mixed soluble silica and alumina precursors because he clearly seeks a certain degree of homogeneity in the resulting silica-alumina support in order to bring about an improved mechanical stability to the silica-alumina support structure. *Roy-Auberger's* teaching thus infers that any support preparation method which does not comprise the co-precipitation of precursors of silicon and aluminum would result in a silica-alumina support structure that would not be satisfactory in his view in terms of mechanical stability for use in a three-phase reactor. In other words, *Roy-Auberger* would not be satisfied in a preparation method in which the mixing of silica and alumina precursors followed by a calcining step would result in a 'silica' coating on alumina. For example, the comparative Catalyst F in *Roy-Auberger* which is made by the impregnation of tetraethoxysilane into *microbeads* of Puralox scca alumina (that is to say, in solid form) does not have the enhanced mechanical stability that *Roy-Auberger* seeks (*Roy-Auberger* Col. 9 lines 23-31; Col. 11 lines 5-19). Therefore, a preparation method which comprises drying and calcining of a mixture containing a silicon precursor and a *solid crystalline* alumina precursor like boehmite would not be seen as desirable by *Roy-Auberger*. Thus, *Roy-Auberger teaches away* from any surface coating method that would result in uneven distribution of Si and Al in the support

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structure, and as such, *Roy-Auberger* teaches away from the support structure resulting from the method of preparation of the present claimed application, as doing so would destroy the intended purpose of *Roy-Auberger* in achieving high homogeneity of Si and Al in the structure of the catalyst support.

Moreover, *Roy-Auberger* does not provide any teaching with respect to the use of a co-precipitated silica-alumina as being at least part of the structural stabilizer in the stabilized alumina, since the stabilized silica-alumina of *Roy-Auberger* consists of, or consists essentially of, the support itself.

Therefore, there is no suggestion or motivation to modify the teaching of the primary reference *Singleton* with *Roy-Auberger* to provide the support structure in Applicants' present claimed invention

***The combination of Singleton with Roy-Auberger fails to teach the problem***

Furthermore, referring to rejected Claims 123-142, Applicants respectfully disagree with the obviousness rejection as both *Singleton* and *Roy-Auberger* did not recognize the problem that Applicants are addressing. There is no mention in *Roy-Auberger* that the formation of water vapor during Fischer-Tropsch synthesis has or could have an impact on the stability of the silica-alumina support. Similarly to *Singleton*, *Roy-Auberger* never addresses the issue of hydrothermal stability of the support, and how one having of ordinary skill in the art could or should do to address it. To the extent that *Roy-Auberger* teaches the formation of *greater silica/alumina interactions* and the optional use of stabilizing element for enhancing *mechanical* stability of the silica-alumina support, *Roy-Auberger* does not teach nor suggest the use of silica and the optional stabilizing element in alumina in order to enhance the *hydrothermal stability of an alumina support*.

Applicants submit that the teaching by *Singleton* and *Roy-Auberger* of a positive impact of a dopant added to alumina for increasing a certain stability of the support and/or the supported catalyst (such as thermal stability; mechanical strength) does not necessarily teach a positive impact of the same dopant or other dopants to alumina for the purpose of enhancing another stability of the support and/or the supported catalyst (such as hydrothermal stability).



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Applicants respectfully disagree with the rationale of the obviousness rejection for at least the reasons stated above, and submit that a *prima facie* case was not properly set forth for Claims 66-143. Applicants respectfully request the withdrawal of the 103(a) rejection.

#### **IV. Amendments to the Specification**

Paragraph [0132] of the specification as filed has been amended to include serial numbers of patent applications that were not available at the time the application was filed.

#### **V. Conclusion**

In conclusion, Applicants submit that *Singleton* fails to teach all of the elements of independent Claim 66. Moreover, a *prima facie* case of obviousness was not properly set forth for Claims 66-143. Applicants therefore believe that independent Claim 66 is patentable over the applied art. Since the dependent claims 67-143 ultimately carry all the limitations of Claim 66 to which they ultimately refer, Claims 67-143 should, therefore, be allowable as well.

Allowance of Claims 66-143 is respectfully solicited.

In this Response, Applicants may have at times referred to claim limitations in shorthand fashion, or may have focused on a particular claim element. This discussion should not be interpreted to mean that the other limitations can be ignored or dismissed. The claims must be viewed as a whole, and each limitation of the claims must be considered when determining the patentability of the claims. Moreover, it should be understood that there may be other distinctions between the claims and the prior art, which have yet to be raised, but which may be raised in the future. No new matter is introduced by this Response.

This is believed to be a full and complete response to the Office Action of July 29, 2005, as Applicants believe they have addressed the issues raised in the Office Action. Should Applicants not have properly understood the Office Action to which this Response is filed, or there is any remaining issue which the Examiner believes would possibly be resolved by a conversation, the Examiner is invited to call the undersigned at (281) 293-4751 so that further delay in a Notice of Allowance can be avoided.

Should any fees have been inadvertently omitted, or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to Deposit Account Number, 16-

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1575 of ConocoPhillips Company, Houston, Texas and consider this a petition for any necessary extension of time.

Respectfully submitted,

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